

CLAIMS

What Is Claimed Is:

1. A manufacturing method for welding composite glass pipes comprising the steps of:
 - providing an inner glass pipe;
 - providing an outer glass pipe having a diameter at a distal end smaller than at a proximate end;
 - an opening at a distal end of the inner glass pipe is expanded so that an outer periphery of the opening is close to an inner peripheral surface of the outer glass pipe;
 - winding an elongated member about the inner glass pipe to provide a concentric offset between the outer glass pipe and the inner glass pipe when aligned together;
 - inserting the inner glass pipe within the outer glass pipe wherein the elongated member provides a constant spacing between the inner glass pipe and the outer glass pipe; and
 - welding the inner glass pipe to the inner peripheral surface of the outer glass pipe.
2. The manufacturing method of Claim 1 wherein the elongated member is a cotton string.
3. The manufacturing method of Claim 1 wherein the elongated member is spirally wound about the inner glass pipe.
4. A manufacturing method for providing an ion measuring instrument comprising the steps of:
 - providing a first elongated hollow glass pipe;
 - positioning an elongated liquid absorbing member about the first elongated hollow glass pipe;
 - providing a second elongated hollow glass pipe having an inner diameter larger than an outer diameter of the first glass pipe and smaller than the overall

diameter of the elongated liquid absorbing member wrapped about the first elongated hollow glass pipe;

aligning the first elongated hollow glass pipe within the second elongated hollow glass pipe to permit the elongated liquid absorbing member to provide a predetermined space between the first and second glass pipes;

welding the first and second glass pipes to form an elongated space for a reference electrode liquid, the second glass pipe providing a distal space for a measuring electrode liquid;

inserting the reference electrode liquid and the measuring electrode liquid into the welded composite first and second glass tubes; and

providing a reference electrode and a measuring electrode for electrical contact with the respective reference electrode liquid and the measuring electrode liquid to enable measurement of ions in a specimen that contacts the second glass pipe with the measuring electrode liquid.

5. An ion measuring composite electrode comprising:

an outer pipe having a closed distal end with a diameter of a portion adjacent the distal end narrower than a proximal end thereof;

an ion responsive section and a liquid connecting section is provided on the outer pipe; and

an inner pipe is provided within the outer pipe and is spaced from the outer pipe by an elongated member with liquid absorption characteristics to form an annular space for providing a space for a reference liquid; the inner pipe is connected to the outer pipe to form the annular space.

6. The ion measuring composite electrode of Claim 5 wherein the elongated member is a string wound around the inner pipe.

7. The ion measuring composite electrode of Claim 6 wherein the outer pipe and inner pipe are glass that are connected together by welding.

8. The ion measuring composite electrode of Claim 6 wherein a cotton string is wound spirally around the inner pipe.

9. In an improved measuring instrument for measuring a liquid specimen, the improvement comprising:

a composite electrode including an inner pipe spaced by an elongated member wrapped around the inner pipe for offsetting a surrounding hollow outer pipe, the inner pipe is welded to the outer pipe to provide an annular space between the inner and outer pipe for receiving a reference electrode liquid.

10. The improved measuring instrument of Claim 9 wherein the elongated member is a string having hydrophilicity for a reference electrode liquid.

11. The improved measuring instrument of Claim 10 wherein the elongated member is compressed between the inner pipe and the outer pipe to concentrically aligned respective axes of the inner pipe and outer pipe.